

Station Explorer for X-Ray Timing and Navigation Technology (SEXTANT) Project

Game Changing Development Program | Space Technology Mission Directorate (STMD)



ANTICIPATED BENEFITS

To NASA funded missions:

Demonstrate real-time, on-board X-Ray navigation (XNAV) for first time Enable GPS-like autonomous navigation capability available throughout the Solar System, and possibly beyond Enhance Deep Space Network (DSN) capability to serve more missions by augmenting autonomous navigation information Dual-purpose the Neutron-star Interior Composition Explorer (NICER) mission for both fundamental science and demonstrate future navigation technology.

DETAILED DESCRIPTION

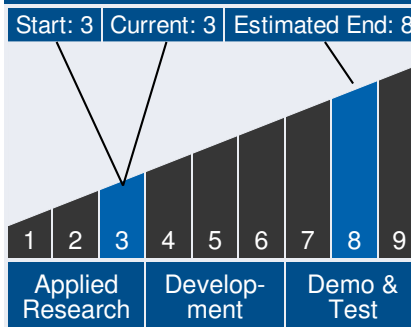
Use millisecond period X-ray emitting neutron stars (Millisecond Pulsars) as beacons to enable GPS-like autonomous navigation anywhere in Solar System and beyond. Explore utility of pulsar-based time scale, and potential to maintain clock synchronization over long distances



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Technology Maturity



Management Team

Program Executive:

- Lanetra Tate

Program Manager:

- Mary Wusk

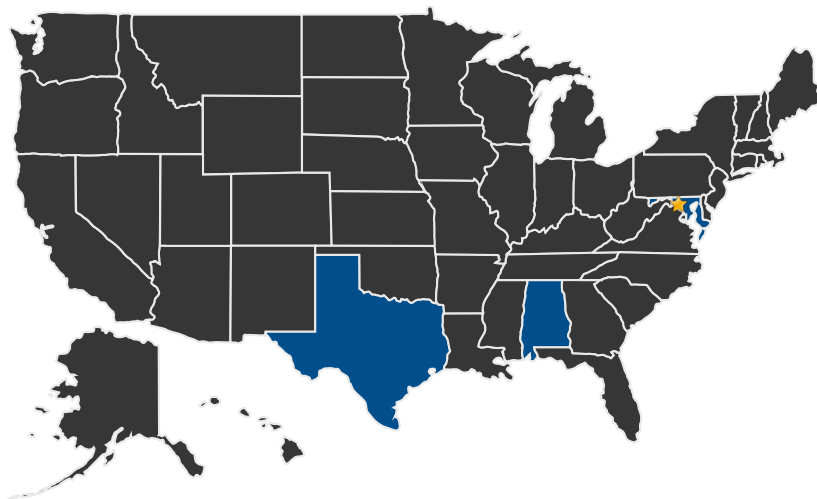
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U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States
With Work

★ **Lead Center:**
Goddard Space Flight Center

Other Organizations Performing Work:

- Amptek
- Cateni Inc Aster Labs
- Cross Trac
- Luxel
- Massachusetts Institute of Technology
- Microcosm
- Moog Broad Reach (Tempe, AZ)
- Naval Research Laboratory
- NOQSI Aerospace
- Okean Solutions

PROJECT LIBRARY

Management Team (cont.)

Project Manager:

- Jason Mitchell

Principal Investigator:

- Ronald Litchford

Technology Areas

Primary Technology Area:

Communications, Navigation, and Orbital Debris Tracking and Characterization Systems (TA 5)

- └ Revolutionary Concepts (TA 5.6)
 - └ X-Ray Navigation (TA 5.6.1)
 - └ X-Ray Navigation (XNAV) (TA 5.6.1.1)
 - └ X-Ray Navigation (XNAV) (TA 5.6.1.1)

Secondary Technology Area:

Communications, Navigation, and Orbital Debris Tracking and Characterization Systems (TA 5)

- └ Position, Navigation, and Timing (TA 5.4)
 - └ Onboard Auto Navigation and Maneuver (TA 5.4.2)

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News Stories

- Interplanetary GPS Comes a Step Closer
 - (<http://spectrum.ieee.org/aerospace/space-flight/interplanetary-gps-comes-a-step-closer>)
- Navigating by Cosmic Beacon
 - (<http://gsfctechnology.gsfc.nasa.gov/CosmicBeacon.html>)
- X-Rays: Next-Gen Way to Travel and Talk in Space?
 - (<http://news.discovery.com/space/private-spaceflight/x-rays-next-gen-way-to-travel-and-talk-in-space-141120.htm>)

Videos

- NASA | SEXTANT: Navigating by Cosmic Beacon
 - (<http://youtu.be/7ixwZQPyWE>)

DETAILS FOR TECHNOLOGY 1

Technology Title

Station Explorer X-Ray Timing and Navigation (SEXTANT)

Technology Description

This technology is categorized as complex electronics software for unmanned spaceflight

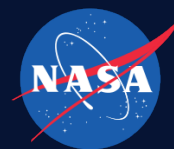
Because of their predictable pulsations, pulsars are highly reliable celestial clocks that can provide the same high-precision timing as the atomic clock signals supplied through the 26 satellite, military operated Global Positioning Satellite System (GPS)—a space-age navigational capability now as ubiquitous as the stars in the sky.

To demonstrate this technique, NICER/SEXTANT will use its 56 X-ray telescopes, detectors, and other advanced technologies to detect X-ray photons from these powerful beams of pulsated light to estimate their arrival times. With these measurements, the system will use specially developed algorithms to stitch together an onboard navigation solution.

Long before the advent of GPS and now NICER/SEXTANT, humans relied on the sky and increasingly more sophisticated technology to find their way. And now, NASA scientists are developing NICER/SEXTANT, the latest incarnation of celestial navigation. This technique could extend humankind's ability to navigate to the farthest reaches of the solar system and potentially beyond using pulsars as a timepiece. In a sense, the development follows a grand tradition that

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began thousands of years ago when the first travelers looked to the skies to venture beyond the horizon.

Capabilities Provided

- Enable GPS-like autonomous navigation capability available throughout the Solar System and beyond

Potential Applications

- Autonomous navigation for deep space missions
- Backup autonomous navigation for human missions
- Dual-function navigation and X-ray astronomy instrument